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Indian Standard

REQUIREMENTS FOR GENERAL PURPOSE CATHODE-RAY OSCILLOSCOPE

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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Indian Standard

REQUIREMENTS FOR GENERAL PURPOSE CATHODE-RAY OSCILLOSCOPE

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(*Continued on page* 2)

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*Shri Y. Venkataramiah was Chairman for the meeting in which this standard was finalized.

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Indian Standard

REQUIREMENTS FOR GENERAL PURPOSE CATHODE-RAY OSCILLOSCOPE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 7 December 1972, after the draft finalized by the Electronic Equipment Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 The object of this standard is to specify the minimum requirements for the performance characteristics of cathode-ray oscilloscope (with the vertical amplifier band width of 20 Hz to 1 MHz and with synchronized sweep characteristics) generally intended for voltage and waveform observations, null indications and time estimates.

0.2.1 This standard also covers characteristics that are to be included in the manufacturer's specification for individual instruments. It is anticipated that this standard would ensure a uniform presentation of these characteristics, to be declared by the manufacturer.

0.2.2 The requirements relating to climatic and mechanical tests are under consideration. With regard to the safety requirements, the cathode-ray oscilloscope should satisfy the requirements specified in IS: 616-1957* so far as they are applicable.

0.3 The measuring equipment employed to carry out the measurements in accordance with this standard shall have an accuracy of at least one order higher than that specified for the quantity under measurement.

0.4 This standard is one of a series of Indian Standards on electronic measuring instruments. A list of standards published so far in this series is given on P 10.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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*Code of safety requirements for mains-operated radio receivers.

†Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard covers the requirements and the characteristics to be specified for general purpose cathode-ray oscilloscope with the vertical amplifier band width of 20 Hz to 1 MHz.

1.1.1 This standard applies to complete apparatus and not to the component parts thereof.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions included in IS : 4330-1967* shall apply.

3. METHODS OF MEASUREMENTS

3.1 The performance requirements specified in this standard shall be measured by the test methods prescribed in IS : 4330-1967*.

4. GENERAL

4.1 Cathode-Ray Tube and Its Controls

4.1.1 The cathode-ray tube face diameter in millimetres, the measuring area (*see* **2.2.4** of IS : 4330-1967*), the type of face and the screen shall be specified.

4.1.2 The vertical and horizontal plates shall be made accessible at the back or side of the instrument (which, however, may be covered with removable plates for safety).

4.2 Cathode-Ray Oscilloscope Controls — All controls necessary for a satisfactory operation of the cathode-ray oscilloscope shall be provided. The following controls, either single or in combination, shall be provided on the front panel of the instrument:

a) Intensity control,
b) Focus control,
c) Vertical shift control,
d) Horizontal shift control,
e) Vertical sensitivity control,
f) Sweep rate control, and
g) Synchronizing control (if synchronization facility is provided).

4.2.1 The vertical and horizontal shift controls shall be designed so that it shall be possible to move the spot by 60 percent of the diameter of the tube on either direction from the centre.

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*Methods of measurements on cathode-ray oscilloscope (dc to 10 Mc/s).

4.2.2 Facility to modulate the intensity or brilliance of the trace may be provided.

4.3 Internal calibration facility may also be provided as an optional feature.

5. PERFORMANCE OF VERTICAL DEFLECTION SYSTEM

5.1 Sensitivity — The sensitivity shall be at least 50 mV (peak to peak) per centimetre at 1 kHz.

5.1.1 Suitable sensitivity controls shall be provided such that any signal above 100 mV (peak to peak) is capable of being displayed to at least 2 cm.

5.1.2 The error at the graduated points of sensitivity shall not exceed 20 percent.

5.1.3 The cathode-ray oscilloscope should be capable of measuring an input voltage of up to at least 300 V (peak to peak) ac and 400 V (dc + peak ac).

5.2 Linearity — The linearity error shall not exceed 5·0 percent over the measuring area.

5.3 Frequency Response — The frequency range over which the sensitivity lies within $^{+1}_{-0}$ dB of the sensitivity at 1 kHz shall be at least from 20 Hz to 1 MHz.

5.4 Input Impedance — The ac input impedance expressed in terms of its equivalent parallel combination of resistive and reactive components at 100 kHz shall be as follows:

Input resistance	1 MΩ (*Min*)
Input capacitance	40 pF (*Max*)

5.5 Influence on Sensitivity

5.5.1 *Of Supply Voltage Variation* — The maximum change in the value of sensitivity for a supply voltage variation of ± 10 percent shall not exceed 5·0 percent.

5.5.2 *Of Supply Frequency Variation* — Under consideration.

5.5.3 *Of Temperature Variation* — The maximum change in the value of sensitivity over an ambient temperature range of 0°C to 45°C shall not exceed 5·0 percent.

5.5.4 *Periodic (Random) Vertical Fluctuations* — This shall be less than 1·0 mm at the maximum sensitivity.

NOTE — Method of measurement for this characteristic is under consideration.

6. PERFORMANCE OF HORIZONTAL DEFLECTION SYSTEM

6.1 Sweep Characteristics for Synchronized Cathode-Ray Oscilloscope

6.1.1 *Sweep Rate* — The sweep rate shall have a range of at least 20 Hz to 50 kHz.

6.1.2 *Linearity Error* — The linearity error shall not exceed 10·0 percent over the measuring area.

6.1.3 *Internal Synchronizing Threshold* — The minimum internal input level required to produce a stationary pattern over the frequency range of 20 Hz to 1 MHz shall not exceed that corresponding to a vertical deflection of 1 cm.

6.1.4 *External Synchronizing Threshold* — The minimum external input level required to produce a stationary pattern over the frequency range of 20 Hz to 1 MHz shall not exceed 5 V (peak to peak).

6.1.5 *Sweep Instability* — The sweep instability shall not exceed 2·0 percent when measured over a period of 15 minutes, after the specified warm-up period.

6.1.6 *Jitter* — The jitter shall not exceed 2·0 percent of sweep length.

6.1.7 *Influence on Sweep Rate*

6.1.7.1 *Of supply voltage variation* — The maximum change in the value of sweep rate for a supply voltage variation of ± 10 percent shall not exceed 5·0 percent.

6.1.7.2 *Of supply frequency variation* — Under consideration.

6.1.7.3 *Of temperature variation* — The maximum change in the value of sweep rate over an ambient temperature of 0°C to 45°C shall not exceed 5·0 percent.

6.2 External Signal Input Characteristics

6.2.1 *Sensitivity* — The sensitivity shall be at least 250 mV (peak to peak) per centimetre at 1 kHz. The cathode-ray oscilloscope should be capable of measuring an input voltage of at least 100 V (peak to peak).

6.2.2 *Linearity* — The linearity error shall not exceed 5·0 percent over the measuring area.

6.2.3 *Frequency Response* — The frequency range over which the sensitivity lies within ± 3 dB of the sensitivity at 1 kHz shall be at least from 20 Hz to 100 kHz (*see also* **5.3**).

6.2.4 *Input Impedance* — The ac input impedance expressed in terms of its equivalent parallel combination of resistive and reactive components at 100 kHz shall be as follows:

Input resistance	100 kΩ (*Min*)
Input capacitance	40 pF (*Max*)

6.2.5 *Influence on Sensitivity*

6.2.5.1 *Of supply voltage variation* — The maximum change in the value of sensitivity for a supply voltage variation of ± 10 percent shall not exceed 5·0 percent.

6.2.5.2 *Of supply frequency variation* — Under consideration.

6.2.5.3 *Of temperature variation* — The maximum change in the value of sensitivity over an ambient temperature range of 0°C to 45°C shall not exceed 5·0 percent.

6.2.5.4 *Periodic (random) horizontal fluctuations* — This shall be less than 1·0 mm at the maximum sensitivity.

NOTE — Method of measurement for this characteristic is under consideration.

7. OTHER REQUIREMENTS

7.1 Magnetic Radiation from Cathode-Ray Oscilloscope — Under consideration.

7.2 Brightness — Under consideration.

7.3 Drift — The drift over a period of 15 minutes in any direction, shall be less than 1·0 mm.

7.4 Effect of External Magnetic Field — Under consideration.

NOTE — This was considered an important characteristic as this would result in shifting the trace or defocussing of the spot.

7.5 Blanking — The return trace shall be suitably blanked.

7.6 Spot Size — Under consideration.

8. TERMINALS

8.1 The oscilloscope shall be provided with suitable terminals for the vertical and horizontal amplifiers, external synchronization inputs and any other signal input or output points.

9. MARKING

9.1 Each oscilloscope shall be marked clearly and indelibly in accordance with Appendix A of IS : 4330-1967*.

10. TECHNICAL MANUAL

10.1 Each oscilloscope shall be provided with a copy of the technical manual prepared in accordance with IS : 6756-1972†.

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*Methods of measurements on cathode-ray oscilloscope (dc to 10 Mc/s).

†Technical documentation to be supplied with electronic measuring equipment (under print).

(*Continued from page* 2)

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INDIAN STANDARDS ON ELECTRONIC EQUIPMENT

IS:

614-1964	Methods of measurement on receivers for amplitude modulation broadcast transmission (*revised*)
615-1966	Minimum requirements of domestic radio receivers (*revised*)
616-1957	Code of safety requirements for mains-operated radio receivers
705-1955	Dry battery operated community radio receivers (*tentative*)
706-1955	ac Mains-operated community radio receivers (*tentative*)
1036-1957	6-Volts accumulator-operated community radio receivers
1885(Part XVIII)-1967	Electrotechnical vocabulary : Part XVIII General terms on radiocommunications
1885(Part XIX)-1967	Electrotechnical vocabulary : Part XIX Radiocommunication circuits
1885(Part XX)-1967	Electrotechnical vocabulary : Part XX Radiowave propagation
1885(Part XXI)-1967	Electrotechnical vocabulary : Part XXI Aerials
1885(Part XXII)-1967	Electrotechnical vocabulary : Part XXII Equipments for radiocommunications, transmitting and receiving
1885(Part XXIII)-1967	Electrotechnical vocabulary : Part XXIII Radio telegraphy and mobile radio
1885(Part XXIV)-1967	Electrotechnical vocabulary : Part XXIV Broadcasting, sound and television
1885(Part XXV)-1967	Electrotechnical vocabulary : Part XXV Radiolocation and radio-navigation
2320-1963	Methods of measurements for amplitude modulated radio frequency signal generators (30 kc/s to 30 Mc/s)
2321-1963	Requirements for general purpose amplitude modulated radio frequency signal generators (30 kc/s to 30 Mc/s)
2711-1966	Direct reading *p*H meters (*revised*)
2731-1964	Methods of measurements on receivers for frequency modulation broadcast transmissions
3397-1966	Dry battery-operated community radio receivers utilizing transistors
3437-1972	General requirements for direct reading pointer indicator type electronic voltmeter (*first revision*)
3886-1966	Minimum requirements for general purpose audio frequency signal generators (30 c/s to 30 kc/s)
3915-1960	Methods of measurements on audio frequency signal generators (30 c/s to 30 kc/s)
4309-1967	Methods of measurements on direct reading *p*H meters
4330-1967	Methods of measurements on cathode-ray oscilloscope (dc to 10 Mc/s)
4545-1968	Methods of measurements on receivers for monochrome television broadcast transmissions
4546-1968	Methods of measurement of radiations from television receivers
4547-1968	Performance requirements of receivers for monochrome television broadcast transmission

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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